

Technology Development Presentation

Powercorp Group

Powercorp Operations Pty Ltd

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Powercorp Alaska LLC

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Power Quality Products

1) Dynamic Grid Interface (DGI)

Use of loads to stabilise power systems (uni-directional)

2) Low Load Diesel (DGI plus special diesel generator)

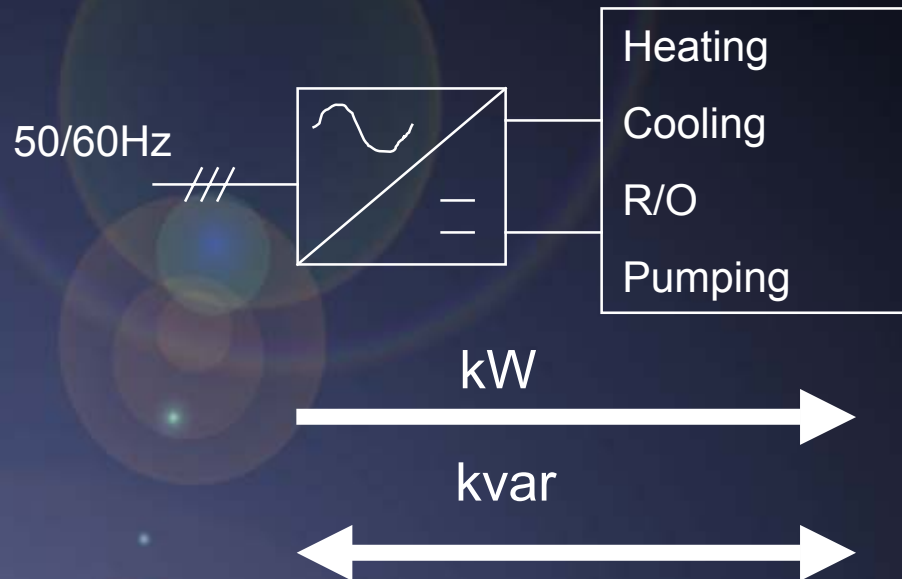
Use of special diesel generator plus DGI to stabilize power systems (bi-directional)

3) PowerStore (FGI plus flywheel)

Use of flywheels to stabilise power systems (bi-directional)

1) DGI - Overview

Dynamic Grid Interface TM (Patented)



1) DGI – Features

- Extremely fast response time – 0 to 100% in 5ms
 - Provides spinning reserve
 - Stabilizes fluctuations in the wind energy
- Highly integrated with station control system
- Voltage and frequency support modes
- Source or sink reactive power

1) DGI – Mawson Example



- Two 150kW Boilers
- Two 100kW DGI Inverters
- Option for additional 100kW DGI

1) DGI – Mawson Performance

Station:

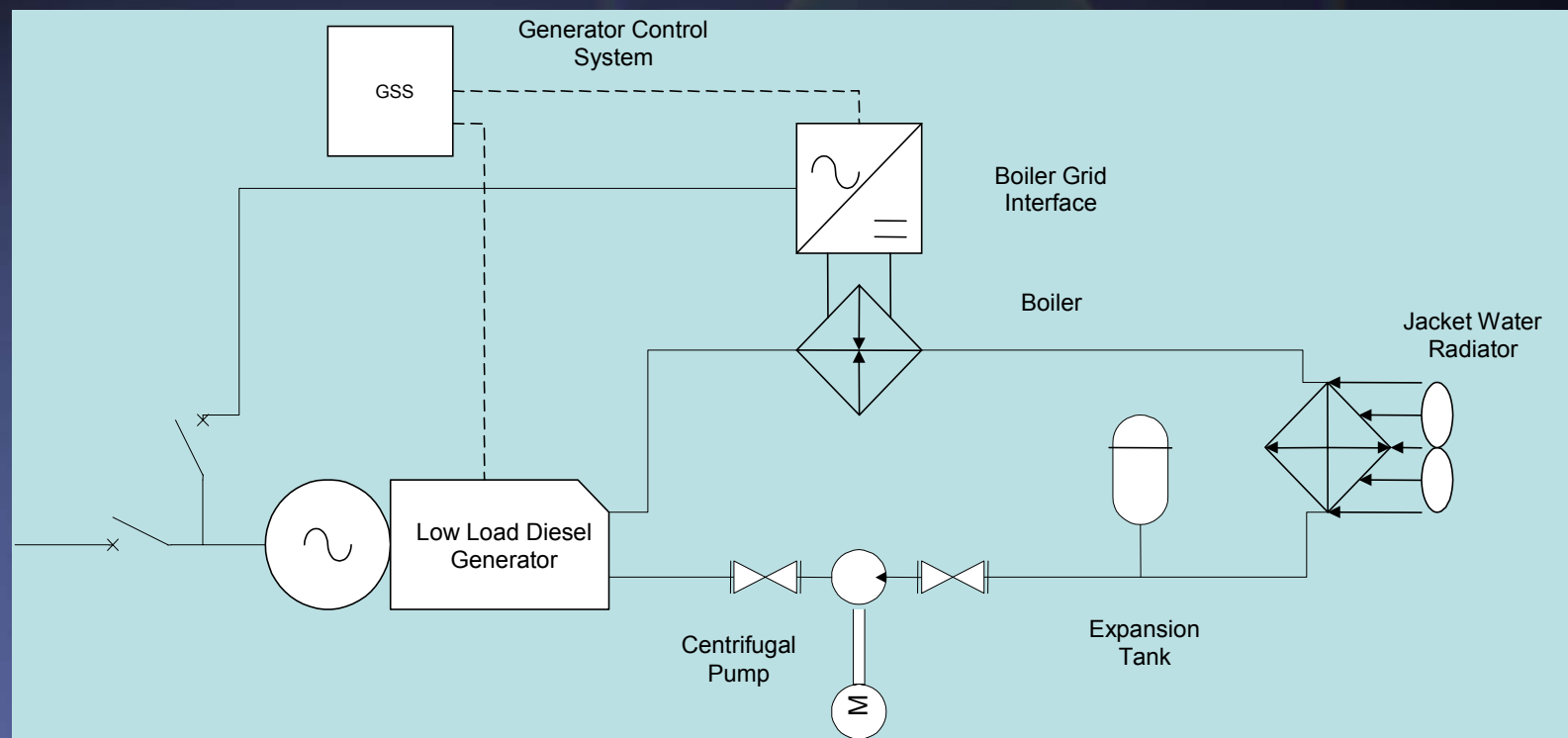
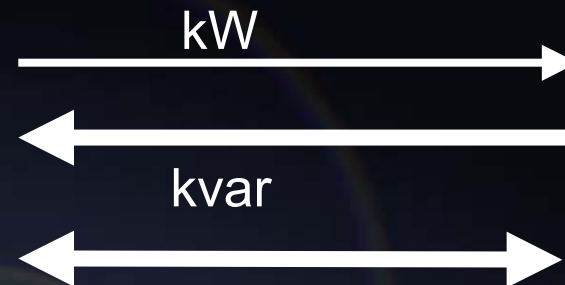
- 4x 125kW diesels
- 2x 300kW ENERCON E30
- 200-250kW electrical load
- 75kW ice melting heater
with on/off control
- 200kW DGI

Performance:

- Operate on 1 diesel engine
- 90% wind penetration
- Entire electrical and heating
load supplied
- Enabled frequency support,
from +/-0.75Hz to +/-0.1Hz
- Injected reactive power to
improve system stability

2) Low Load Diesel - Overview

320kW diesel generator with fast energy sink



2) Low Load Diesel – Features

- 320kW Detroit Series 60 Diesel Generator
- Designed to run at very low load
- Operation at -30% to 110% of rated power
- Fast response from EFI diesel and power electronics
- Voltage and frequency support modes
- Source or sink reactive power
- Available as a containerized unit

2) Low Load Diesel - Denham



2) Low Load Diesel - Performance

Denham Station:

- 2x 280kW diesels
- 2x 580kW diesels
- 3x 230kW ENERCON E30
- 450-1100kW electrical load
- 1x Low Load Diesel
- 1x additional Low Load

Diesel installed in late 2004

Denham Performance:

- 50-60% wind penetration
- 80-90% penetration after
second Low Load Diesel
- 11,000 gal reduction in fuel
- 1,400 ton reduction in
greenhouse gases

2) Low Load Diesel - Container



2) Low Load Diesel - Container



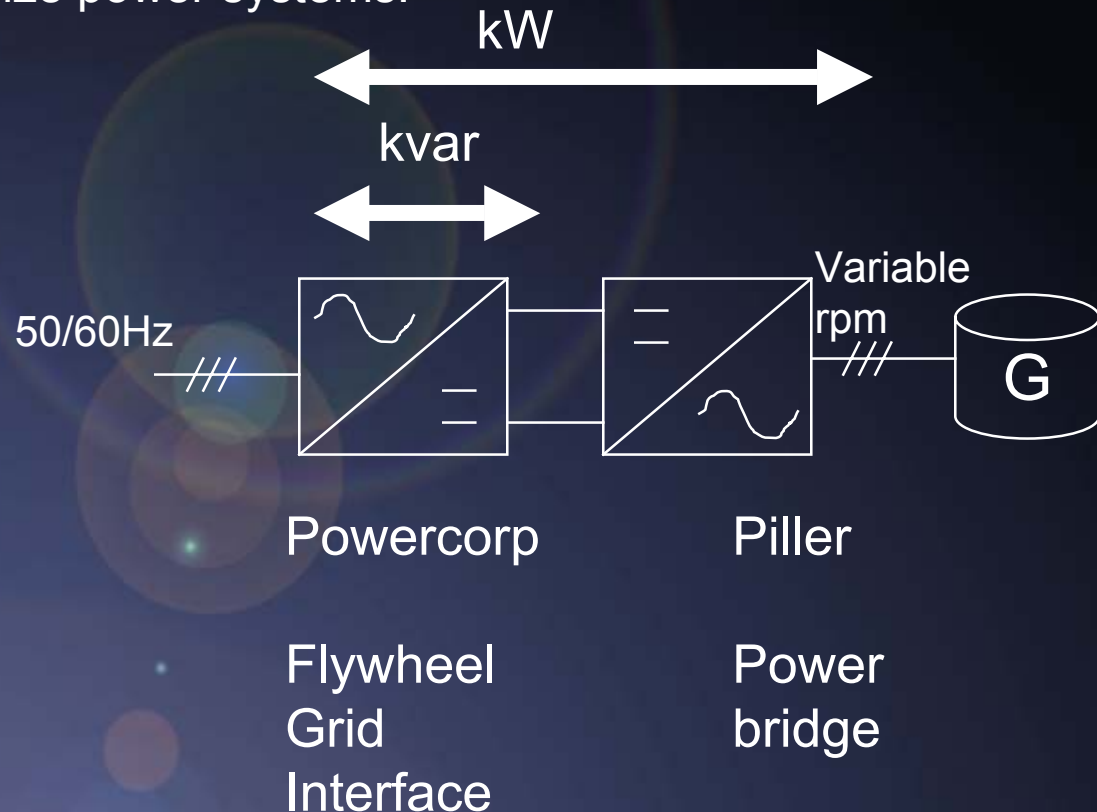
2) Low Load Diesel - Container



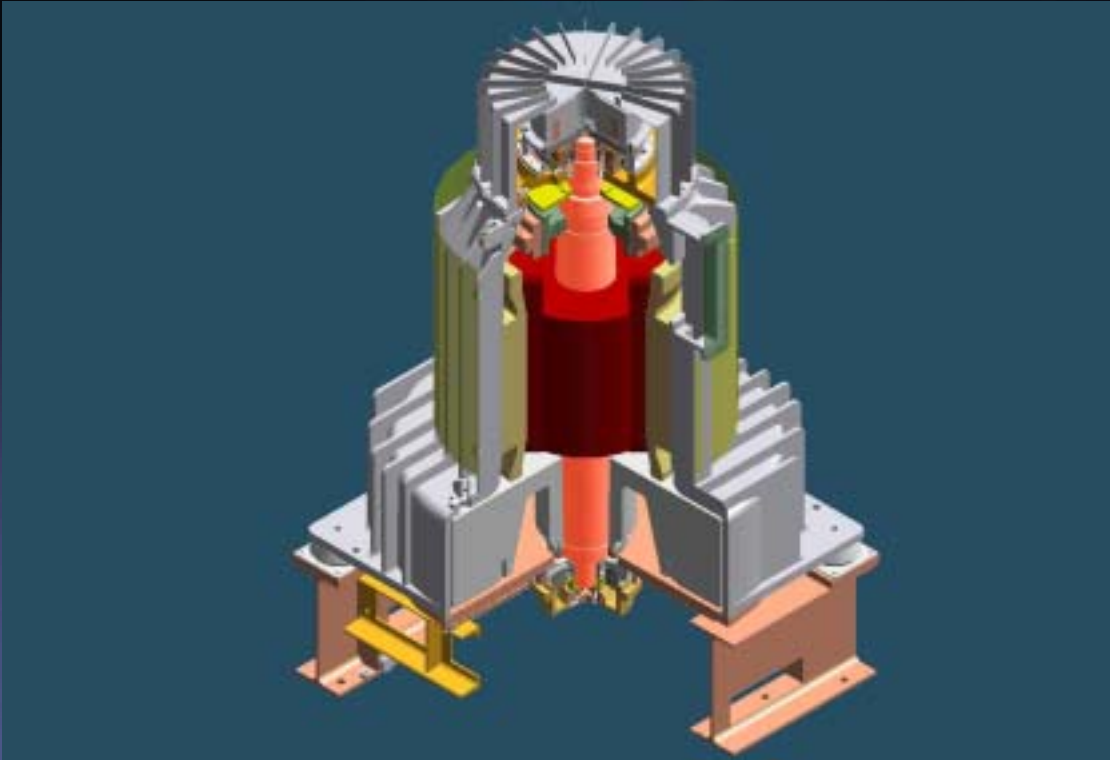
3) PowerStore™ - Overview

PowerStore™

Energy Storage System to stabilize power systems.



3) PowerStore™ - Piller Powerbridge



3) PowerStore™ - Features



- Very high cycling capability (charge and discharge)
- 20 year design life
- Full power (1,000kW) within 5 ms
- Low speed flywheel max 3,800 rpm
- Guaranteed energy level and remote condition monitoring
- Proven technology using Piller Powerbridge
- Max power rating 1,000kW for 15sec

Synchronous Condensers

	S.C.	DGI	LLD	Power-Store
kVARs	X	X	X	X
Voltage Ref.	X	X	X	X
Spinning Reserve			X	X

Summary Wind/Diesel

Power Quality Solutions

- Dynamic Grid Interface™
- Low Load Diesel™
- PowerStore™